REMARKS

The Amendment

The Final Office Action dated June 2, 2005 and the advisory action dated September 23, 2005 have been reviewed carefully and claims have been amended and added in a sincere effort to place them in condition for allowance. Reconsideration of rejection of claims previously rejected and allowance of the same and the new claims are respectfully requested. More specifically, claim 1 has been amended to be limited to O tempers and to include an affirmative medium of a quenching device. Claim 8 has been amended to claim types of quenching devices. Claims 5, 14, 16-20, and 26-33 have been cancelled, wherein dependent claim 27 has been amended into dependent claim 3. New claim 34 is directed to a quenching temperature for the quenching after casting. New claims 35-49 and 64 correspond to claims 1, 3-4, 6-13, 15, 17 and 22-25 except that they are limited to T tempers. New claims 50-63 include a quench post-hot-or-warm rolling and form T (claims 57-63) or O (claims 50-56) tempers without cold rolling. New claims 65-66 include a specific quenching rate after casting and prior to hot or warm rolling.

The Invention

The invention provides a continuous in-line process to form an aluminum alloy of either T or O temper that meets the criteria defined by the Aluminum Association. The invention is a significant advancement over the prior art in that *conventional T and O tempers are formed in an in-line process* without requiring the multiple steps of the existing methods. While aluminum sheet has been made in an in-line process in prior art, it has been of a mixed temper of strain hardened (H temper) and age hardened (T) material. It has long been a goal in the field of metallurgy to produce commercial T or O tempers *in-line*. Such an in-line process carries important value in the marketplace as it substantially reduces the time to process the alloys from feedstock to T or O temper finished alloys. In the present invention, this is achieved by casting a thin strip at high speeds to create a fine

microstructure that substantially retains the alloying elements in solution. The strip is then rapidly processed in line by hot or warm rolling which enables the subsequent solution heat treating or annealing steps to be carried out by flash heating of the sheet in line at much lower temperatures than industry practice. The fine microstructure of the thin as-cast strip, the retention of the solutes in solution by rapid processing and the resulting lower temperature requirements for anneal and solution heat treat has made possible the manufacturing of O and T temper sheet in line by the inventive method.

The process includes the steps of providing a continuously-cast aluminum alloy strip as feedstock; quenching the feedstock to a preferred hot rolling temperature with an in-line quenching device; hot or warm rolling the quenched feedstock to the required thickness, annealing or solution heat-treating the feedstock in-line depending on whether a T or O temper is desired to produce the T or O temper aluminum alloy sheet. New claims 50-63 have been added to claim formation of T or O tempers without requiring cold rolling post annealing or solution heat treating. New claims 65-66 have been added to claim specific quenching conditions after casting and prior to hot or warm rolling.

Claims 1, 4-7, 10-13, 15-18, 21, 22 and 27-32; Rejected Under 35 U.S.C. § 103(a) by United States Patent 5,769,972 to Sun

The above claims are rejected under 35 U.S.C. § 103(a) as being unpatentable in view of Sun. Claims 5, 16-18 and 27-32 have been cancelled. Sun is cited for teaching a process of manufacturing an aluminum alloy sheet stock by continuously casting a strip, hot rolling the strip, and annealing the strip.

Regarding the quenching step after casting

The examiner cites Sun for teaching that (a) it is known in the art to water quench after casting and prior to further heat treating, and (b) it is known that quenching after casting,

though less energy efficient, achieves a strong dilute aluminum alloy. See page 2 of Final Office Action. Applicants disagree, however, that Sun teaches quenching after casting and before hot rolling. Instead, Sun is disclosing a rapid quenching *after* the hot rolling, *not* after the casting of the feedstock and prior to the hot rolling as claimed in the present invention. Specifically, regarding part (a), above, Sun dismisses quenching prior to annealing as thermodynamically inefficient. The Examiner takes this to mean that quenching after casting and prior to hot rolling is disclosed. However, when Sun discusses what type of quenching is being dismissed, as in part (b), above, Sun references Ser. No. 531,554, since matured into Patent No. 5,772,799, as disclosing the action of rapidly quenching feedstock. The referenced '799 patent, however, clearly states that the rapid quenching occurs after hot rolling and prior to cold rolling. See Column 4, lines 3-20 and Fig. 1 of the '799 patent. Essentially, the rapid quenching that was dismissed as thermodynamically inefficient in Sun refers to quenching that occurs prior to annealing and after hot rolling as disclosed in '799. Therefore, there is no quenching disclosed after casting in Sun.

In the advisory action, the Examiner stated that the '799 reference *does* disclose quenching prior to rolling, citing both column 6, lines 51-52 and in claim 1. However, in both instances, quenching is done prior to cold rolling, not hot or warm rolling as claimed by Applicant. By teaching quenching before cold rolling and not hot or warm rolling, the '799 teaches away from the method claimed by Applicant in independent claims 1, 35, 65 and 66 and claims dependent there from. This is not insignificant, as there would not be any so-called "thermodynamic inefficiency" to quenching after casting if cold rolling was the subsequent step.

Further, it is important to note that the difference between quenching after casting and prior to hot or warm rolling, as opposed to quenching after hot or warm rolling, is significant. The two quenching techniques were found to have different purposes. It was surprisingly found that the quenching step after casting but before hot or warm rolling can effectively

control grain size in the feedstock. See Applicants specification, page 12, lines 8-18. For example, as stated in Applicants' specification, very fine grain size, if desired, can be achieved by quenching the strip to about 700°F, as now generally claimed in dependent claims 34 and 35. By contrast, the purpose of quenching after hot or warm rolling is to keep alloying elements in solution. See Sun, column 6, lines 26-29.

The Examiner goes on, however, to state that quenching prior to rolling was "necessarily" disclosed in Sun because, although quenching was not specifically disclosed, the temperature of the hot roller is less than that of the casting temperature. See page 3, lines 2-6 of the Action, citing column 6, line 20 of Sun; see also the advisory action. In response, Applicants note that quenching is a physical, affirmative cooling step. The mere citing of temperature at which operations are *performed* does not imply that a sheet is cooled by an affirmative process. To emphasize this, Applicants have amended claim 1 and added claim 35 to include the limitation of a quenching device and have added claims 65-66 to include a quenching rate. In several of Examiner's papers, the Examiner noted that Applicants' claims did not mention a particular cooling/quenching rate or a quenching medium. See, e.g., Final Office Action, page 5, second full paragraph. Applicants respectfully submit that a cooling/quenching rate and a quenching medium are now provided, and this distinguished Applicants invention over any incidental cooling that may be necessitated in Sun. The support for these additions is found in Applicants' specification page 6.

Thus, Sun does not teach casting followed by quenching by a quenching device for feeding into a hot or warm rolling mill as claimed in Applicants' amended independent claim 1 and new independent claim 35. As stated in, *In re Vaeck*, 947 F.2d 488, 20 U.S.P.Q.2d 1438 (Fed. Cir. 1991), "both the suggestion [to make the claimed apparatus] and the reasonable expectation of success must be found in the prior art, not in the Applicants' disclosure." Therefore, even if Sun discloses certain components of the present invention, it does not disclose or suggest the specific order of steps as claimed by Applicants or the advantages

attendant thereto, for example, rapid production of T or O defined tempers that can be tension leveled without requiring cold rolling.

Regarding the formation of T or O tempers

In the response by Applicants on March 7, 2005, Applicants amended the claims to further emphasize the fact that the process is forming T or O tempers in an in-line sequence. In the rejection of Applicants claims over Sun (numbered paragraph 2), the Examiner did not significantly acknowledge the inclusion of this amendment. The Examiner only addresses and swiftly discounts the inclusion in numbered paragraph 12, wherein it is stated that "the prior art teaches steps of annealing or solution heat treating, thereby providing said temper conditions." The Examiner further reiterated in the advisory action that the formation of a T or O temper is simply the result of performing annealing or solution heat treating. The formation of T or O temper, however, is dependent on the entire four step process.

Sun does not teach the formation of T or O tempers. Sun, which is commonly owned by Applicants, teaches a formation of a special temper, which, in-house, is called a "micromill temper." "Micromill tempers" have different properties than defined T or O tempers. Thus, under the teachings of Sun, the end result would be a mixed temper, not T or O. Additionally, there is no express teaching or mention of T or O tempers in Sun, and there is no data that supports the formation of T or O tempers with properties defined by the Aluminum Association.

Further, not only does Sun not teach T or O tempers, it teaches away from T or O tempers. "A prior art reference may be considered to teach away when "a person of ordinary skill, upon reading the reference, would be discouraged from following the path set out in the reference, or would be led in a direction divergent from the path that was taken by the applicant." Monarch Knitting Mach. Corp. v. Sulzer Morat GmbH, 139 F.3d 877, 885 (Fed. Cir. 1998). Sun teaches a temper that is utilized in can ends. See column 5, lines

5053. Can ends are not T or O temper. One skilled in the art would not utilize a process directed to can ends to create a T or O temper. Thus, the mere recitation of annealing or solution heat treating in cited references is not enabling disclosure of the formation of a T or O temper, and thus Applicants' invention is not made obvious by Sun under §103.

The Applicant's invention, however, *does* teach T or O tempers and provides support for such, as shown in the examples and the data. See, for example, table 1, page 10; table 3, page 12; table 5, page 15; Examples 3 and 4, pages 16-17. As stated earlier, the formation of T or O tempers in-line has long been a goal in the field of metallurgy. Thus, while Applicants' invention achieves this goal, Sun does not, and such a difference is surprising and by no means obvious.

Further, Sun does not teach or suggest solution heat treating. In column 6, lines 23-29, Sun states that the "annealing step in which the feedstock is subjected to solution heat treatment to cause recrystiallization...." However, solution heat treatment is not truly happening in Sun. It is highly atypical to conduct annealing and solution heat treating at the same time. Only one is performed at any one time. In the case of Sun, it is clear that only annealing is being performed. This is evidenced by the fact that in the remainder of the specification, figures and claims, only annealing is mentioned. Thus, the reference of solution heat treatment as performed by annealing is in error, and one skilled in the art would know this. Therefore, Applicants' invention is not made obvious by Sun under §103.

Regarding independent claim 28 and dependent claims 29-32.

Claims 28-32 have been cancelled in this amendment.

Regarding claim 27 (amended into claim 3) and new claims 50-63, specifically regarding the lack of required cold rolling after annealing or solution heat treating.

The Examiner states that although cold rolling is disclosed in Sun to stabilize the product, "not performing the step when the action is not desired is an obvious improvement." See page 3-4 of Action. The law cited by Examiner, however, is not on point. Each of the cases cited, as Examiner notes, involves the deletion of a function when the result of that function is not needed or wanted. For example, in Ex Parte Wu, 10 USPQ2d 2031 (Bd. Pat. App. & Inter. 1989), salts that are useful in metals that contact fresh water were not desired in metals that did not encounter fresh water.

In the present invention, however, the function of cold rolling *is* desired, but can expediently be achieved without actually performing the cold rolling. Part of the issue here is that the Examiner omits a reason for cold rolling. On the first line of page 4, the Examiner states that the purpose of cold rolling is "to reduce sheet thickness." However, the purpose of cold rolling at the end of a method is often to provide enough tension in the alloy so that tension leveling can be performed without breakage. It is a significant advantage of the present invention that no such cold rolling is required to perform tension leveling and coiling. In the present invention, cold rolling after solution heat treating or annealing is ruinous to the attainment of the intended T or O tempers, respectively. The use of cold rolling in Sun is imperative for increasing the strength of the metal while at the same reaching the required final thickness. It is a significant advantage of the present invention that no such cold rolling is required to achieve final thickness and strength. As the Examiner herself notes, the "omission of an element and retention of its function is an indicia of unobviousness." In re Edge, 359 F.2d 896, 149 USPQ 566 (CCPA 1966). Here, cold rolling was omitted, but its function of tension leveling was retained, and this claim is not obvious over Sun under §103.

Therefore, for all of the above reasons, pending claims 1, 3-4, 6-13, 15, 17 and 22-25 and new claims 34-66 are believed allowable over Sun.

Claims 1, 4-7, 10-13, 15-18, 21 and 23, 27-32; Rejected Under 35 U.S.C. § 103(a) by United States Patent 5,514,228 to Wyatt-Mair

The above claims are rejected under 35 U.S.C. § 103(a) as being unpatentable over Wyatt-Mair. Claims 5, 16-18 and 27-32 have been cancelled. Wyatt-Mair is directed to a method of manufacturing aluminum wherein feedstock is rolled and then annealed without intermediate cooling.

Regarding the quenching step after casting

Like Sun, above, the Examiner cites Wyatt-Mair for the proposition that while quenching after casting and before hot or warm rolling is not actually disclosed in Wyatt-Mair, it "necessarily teaches" quenching at that stage. As stated above, the independent claim 1 and dependent claims 3-4, 6-13, 15, 21-25, as well as new claims 34-49, now include an in-line quenching device between the caster and the hot or warm roller, which is not disclosed by Wyatt-Mair. Further, new claims 65-66 include a quenching rate. In several of Examiner's papers, the Examiner noted that Applicants' claims did not mention a particular cooling/quenching rate or a quenching medium. See, e.g., Final Office Action, page 5, second full paragraph. Applicants respectfully submit that a cooling/quenching rate and a quenching medium are now provided, and this distinguished Applicants invention over any incidental cooling that may be necessitated in Sun. The support for a these additions are found in Applicants' specification page 6.

Regarding the formation of T or O tempers

In the response by Applicants on March 7, 2005, Applicants amended claim 1 to further emphasize the fact that the process is forming T or O tempers in a single in-line sequence. In the rejection of Applicants claims over Wyatt-Mair (point 3), the Examiner did not adequately acknowledge the inclusion of this amendment. The Examiner discounts the inclusion in point 12, wherein it is stated that "the prior art teaches steps of annealing or solution heat treating, thereby providing said temper conditions." As stated previously, the formation of a T or O temper is not simply the result of performing annealing or solution heat treating. The formation of T or O temper is dependent on the entire four step process. The last step is only a final determinant as to whether T or O temper is formed. The mere recitation of annealing or solution heat treating in cited references is not enabling disclosure of the formation of a T or O temper.

Wyatt-Mair does not teach or suggest the formation of T or O tempers. Wyatt-Mair, which is commonly owned by Applicants and shares a common inventor with the present application, teaches a formation of a different type of temper. There is no express teaching or mention of T or O tempers in Wyatt-Mair, and there is no data that supports the formation of T or O tempers with properties defined by the Aluminum Association. In fact, Wyatt-Mair, which is directed to can assembly, teaches away from the formation of T or O tempers as claimed by Applicants with the requirement of cold rolling after annealing. As stated, in the present invention, cold rolling after solution heat treating or annealing is ruinous to the attainment of the intended T or O tempers, respectively. The use of cold rolling in Sun is imperative for increasing the strength of the metal while at the same reaching the required final thickness. It is a significant advantage of the present invention that no such cold rolling is required to achieve final thickness and strength as T or O tempers. The Applicant's invention, then, does teach T or O tempers and provides support for such, as shown in the examples and the data. See, for example, table 1, page 10; table 3, page 12; table 5, page 15; Examples 3 and 4, pages 16-17. As stated earlier, the

formation of T or O tempers in-line has long been a goal in the field of metallurgy. Thus, while Applicants' invention achieves this goal, Wyatt-Mair does not, and such a difference is surprising and by no means obvious.

Further, Wyatt-Mair does not teach or suggest solution heat treating independent of annealing. In column 32, lines 8-10, Wyatt-Mair states that the "feedstock is thereafter annealed and solution heat treated." Nowhere in the disclosure is solution heat treating mentioned as performed independently of annealing. In contrast, Applicants claim alternative actions. For example, in claim 1, only annealing is claimed. In claim 35, only solution heat treating is claimed.

Regarding independent claim 28 and dependent claims 29-32.

Claims 28-32 have been cancelled. However, Applicants assert that Examiner's use of Wyatt-Mair to show independent annealing vs. solution heat treating is improper. In the action, the Examiner cites annealing to create an O temper as disclosed in column 3 and line 12 of Wyatt-Mair, wherein it is disclosed that "the hot reduced feedstock is thereafter annealed and solution heat treated without substantial intermediate cooling," and then cites solution heat treating to create a T temper as disclosed in claim 1, line 9, wherein it is claimed that the feedstock is "annealing and solution heat treating the reduced feedstock without intermediate cooling...."

In other words, the Examiner cited *virtually the same exact phrase*, once written in the specification of Wyatt-Mair and once written in the claims of Wyatt-Mair, to show two *alternate* actions claimed by the Applicants. How the action disclosed in the specification of Wyatt-Mair can create O tempers while the virtually identical language in the claims of Wyatt-Mair creates T tempers is never explained by the Examiner. Further, as discussed above, by the plain language of the disclosure, both annealing and solution heat treating are being performed on the same feedstock. These are never disclosed independently or

alternatively of each other. There is no disclosure for forming a T temper with one set of criteria that includes solution heat treating or an O temper with an alternate set of criteria that includes annealing, as claimed in Applicants' invention. Further, the terms T and O temper are never even mentioned in Wyatt-Mair.

Such a difference is not obvious. It is well-settled that there must be motivation within a single reference to alter the reference to find patent claims obvious. SIBIA Neurosciences, Inc. v. Cadus Pharm. Corp., 225 F.3d 1349, 1360 (Fed. Cir. 2000). Wyatt-Mair provides no motivation for one skilled in the art to alter the straight line method of Wyatt-Mair into Applicants method that includes T or O tempers.

Regarding claim 27 (amended into claim 3) and claims 50-63 specifically regarding the lack of required cold rolling after annealing or solution heat treating.

The Examiner states that although cold rolling is specifically mentioned in Wyatt-Mair to stabilize the product, because "not performing the step when the action is not desired is an obvious improvement." See page 6 of Action. As stated above, however, in the present invention, the function of cold rolling *is* desired, but can expediently be achieved without actually performing the cold rolling. As the Examiner herself notes, the "omission of an element and retention of its function is an indicia of unobviousness." In re Edge, 359 F.2d 896, 149 USPQ 566 (CCPA 1966). Here, cold rolling was omitted, but its function of tension leveling was retained. As stated prior, part of the issue here is that the Examiner omits a reason for cold rolling. The Examiner states that the purpose of cold rolling is "to reduce sheet thickness." However, the purpose of cold rolling at the end of a method is often to provide enough tension in the alloy so that tension leveling can be performed without breakage. It is a significant advantage of the present invention that no such cold rolling is required to perform tension leveling and coiling.

Therefore, for all of the above reasons, pending claims 1, 3-4, 6-13, 15, 17 and 22-25 and new claims 34-66 are believed allowable over Wyatt-Mair.

Claims 1, 4-7, 9-13, 15-18, 21-23, 27-32 are rejected under 35 U.S.C. 103(a) over Sun or Wyatt-Mair et al. in further view of Zonker.

Zonker is cited for teaching water quenching after casting and before hot rolling. See column 5, line 62 column 6, line 42. However, the process that Zonker teaches is to quench the alloys down to room temperature and then reheat to 510 degrees in about *five minutes* prior to hot rolling. In contrast, the present invention claims "quenching the feedstock *to* a temperature for feeding into a hot or warm rolling mill" (emphasis added). Further, this is not an obvious difference, as Zonker is directed to a slower, non-in-line process. For example, the slabs of Zonker are slow cooled after hot rolling at a rate of 10°C *per hour*. See column 6, lines 1-2. In contrast, the present invention specifically claims an "in-line" process.

As stated in, *In re Geiger*, 815 F.2d 686, 2 U.S.P.Q.2d 1276 (Fed. Cir. 1987), a copy of which is provided herewith for the Examiner's convenience, "obviousness cannot be established by combining teachings of the prior art to produce the claimed invention, *absent some teaching, suggestion, or incentive supporting combination*" (emphasis added). There is no motivation to combine the results from a non-in-line process such as Zonker with an in-line process as Wyatt Mair or Sun.

In the advisory action, the Examiner dismisses Applicants argument by stating the quenching Applicants refer to occurs after, not before, rolling. However, Zonker's disclosure "quench the alloys down to room temperature and then reheat to 510 degrees in about five minutes prior to hot rolling" *does* happen prior to rolling. Applicants' subsequent mention of Zonker cooling slabs after hot rolling at 10°C per hour was merely a reference to the fact that Zonker is clearly not an in-line process.

It is further submitted that the arguments cited above against Sun and Wyatt-Mair are equally applicable here. Thus, Zonker does not teach or make obvious the invention as claimed in the Applicants' amended claims, wherein an aluminum alloy sheet in a continuous in-line process is continuously cast, quenched to a preferred hot rolling temperature with a quenching device, hot or warm rolled, and annealed or solution heat-treated in-line depending on the alloy and the T or O temper desired as claimed in Applicants' amended claim 1, nor does it show the alternative criteria of amended claim 28. Therefore, claims 1, 3-4, 6-13, 15, 17 and 22-25 and new claims 34-66 are not obvious over the above reference.

Claim 3 is rejected under 35 U.S.C. 103(a) over Sun or Wyatt-Mair in further view of United States Patent No. 5,106,429 to McAuliffe.

McAuliffe teaches a process wherein an alloy of a particular composition is cast into a cast strip, hot rolled, annealed, cold rolled and tension leveled. See Column 6, lines 51-53. According to McAuliffe, the cold rolling reduces thickness, provides better uniformity (column 8, lines 13-15), reduces earing (column 8, lines 45-47), and stabilizes (column 8, lines 58-60). The stabilization reduces the physical properties of the aluminum so that the aluminum sheet will not experience any substantial decrease in strength during subsequent processing. See column 9, lines 7-10. The tension leveling achieves a more uniform flatness after the final cold rolling pass. See column 23, lines 11-14.

Thus, McAuliffe teaches tension leveling only after the stabilizing effects of cold rolling. As previously stated, it is a significant advantage of the present invention that cold rolling is not required. Thus, as claimed in claim 3 of the present invention, tension leveling and coiling the feedstock can be performed without cold rolling prior to the tension leveling and the coiling the aluminum alloy sheet. Thus, combination of Zonker with Sun or Wyatt-Mair would not result in the present invention, and it would not be obvious for one

skilled in the art to use the teachings of McAuliffe to tension level the alloy after annealing or solution heat treating without stabilizing the alloy with cold rolling. Therefore amended claim 3 is not obvious over the cited references.

Claims 14 and 19 are rejected under 35 U.S.C. 103(a) over Sun or Wyatt-Mair in further view of "ASM Handbook: Vol. 4 Heat Treating" pp. 851-857.

The ASM handbook teaches air quenching and air plus water quenching. Claim 14 is not asserted as independently contributing to patentability apart from the independency on rewritten independent Claim 1, dependent claims 11 and 13. Claim 19 has been canceled. It is submitted, however, that the arguments cited regarding Sun and Wyatt-Mair are equally applicable here. Thus, the ASM handbook does not teach or make obvious the invention as claimed in the Applicants' amended claims, wherein an aluminum alloy sheet in a continuous in-line process is continuously cast, quenched to a preferred hot rolling temperature with a quenching device, hot or warm rolled, and annealed or solution heat-treated in-line depending on the alloy and the T or O temper desired, as claimed in Applicants' amended claim 1. Therefore, as it depends from claim 1 through intervening claims 11 and 13, claim 14 is not obvious over the above reference.

Claim 20 is rejected under 35 U.S.C. 103(a) over Sun optionally combined with Zonker.

Claim 20 has been cancelled.

Claims 23-26 are rejected under 35 U.S.C. 103(a) over Sun or Wyatt-Mair in further view of United States Patent No. 5,833,775 to Newton.

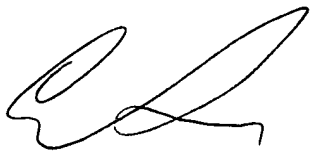
Newton teaches use of additional rolling steps. Claims 23-25 are not asserted as independently contributing to patentability apart from the independency on rewritten independent claim 1 and any intervening claim. Claim 26 has been cancelled. However,

Sun or Wyatt-Mair, as argued previously, do not teach or make obvious the invention as claimed in the Applicants' amended claims, wherein an aluminum alloy sheet in a continuous in-line process is continuously cast, quenched to a preferred hot rolling temperature with a quenching device, hot or warm rolled, and annealed or solution heat-treated in-line depending on the alloy and the T or O temper desired as claimed in Applicants' amended claim 1. Therefore, as claims 23-25 depend from claim 1 either directly or through intervening claims, claims 23-25 are not obvious over the cited references.

CONCLUSION

It is submitted that the present amendment obviates the rejections under 35 U.S.C. § 103 by the cited references. As it would appear that claims 1, 3-4, 6-13, 15, 17, 22-25 and 34-66 are in proper form for the issuance of a Notice of Allowance, such action is respectfully requested at an early date.

Respectfully submitted,



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